2004

Generalized Geologic Map for Land-Use Planning: McLean County, Kentucky

E. Glynn Beck
University of Kentucky, ebeck@uky.edu

David A. Williams
University of Kentucky, williams@uky.edu

Daniel I. Carey
University of Kentucky, daniel.carey@uky.edu

Kentucky Geological Survey
James C. Cobb, State Geologist and Director
UNIVERSITY OF KENTUCKY, LEXINGTON

https://doi.org/10.13023/kgs.mc85.12
MAP AND CHART 85
Series XII, 2004

Generalized Geologic Map for Land-Use Planning: McLean County, Kentucky

E. Glynn Beck, David A. Williams, and Daniel I. Carey

Acknowledgments

Bedrock geology adapted from Ashcraft and Hosey (2003), Smith (2003), Solis and Hettinger (2000), Solis and Terry (2000a,b), Tyra and Crawford (2003), Tyra and Terry (2000), and Tyra and Venard (2000a,b). Thanks to Greg Henson, McLean County Agriculture and Natural Resources agent, for photographic assistance.

For Planning Use Only

This map is not intended to be used for selecting individual sites. Its purpose is to inform land-use planners, government officials, and the public in a general way about geologic bedrock conditions that affect the selection of sites for various purposes. The properties of thick soils may supercede those of the underlying bedrock and should be considered on a site-to-site basis. At any site, it is important to understand the characteristics of both the soils and the underlying rock. For further assistance, contact the Kentucky Geological Survey, Western Kentucky Office, 1401 Corporate Court, Henderson, KY 42420, phone 270.827.3414 or 270.827.3404. For more information, and to make custom maps of your local area, visit our Land-Use Planning Internet Mapping Web Site at kgsmap.uky.edu/website/kyluplan/viewer.htm.

EXPLANATION

- School
- Urban services boundary
- Wetlands > 1 acre (U.S. Fish & Wildlife Service, 2003)
- Source water protection area, zone 1
- Water
- Surface mine
- Artificial fill
- Underground mine
- Mine shaft
- Mine adit
- Watershed divide
- Concealed faults
- Faults
- Projected faults

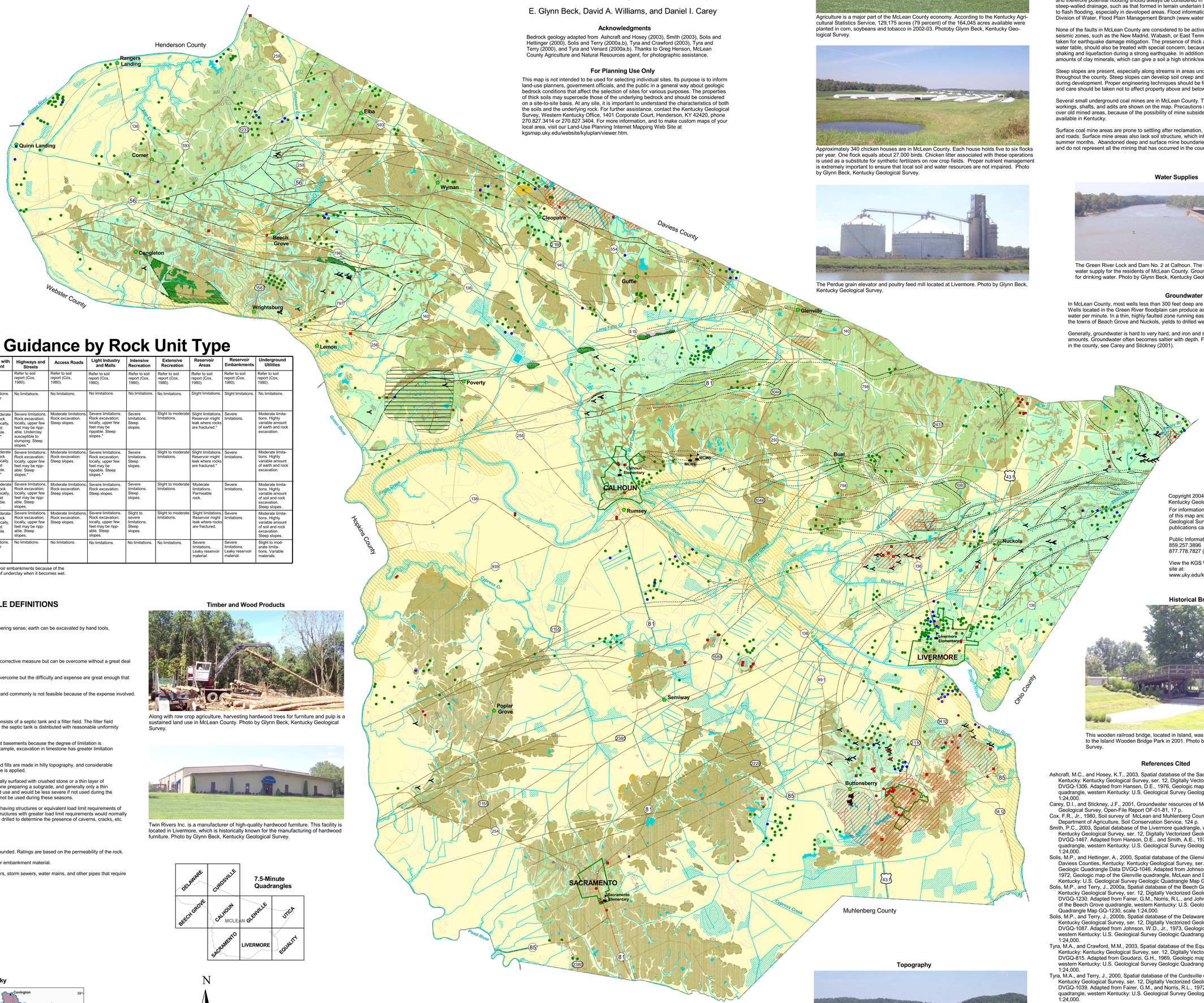
Water Wells
- Domestic
- Industrial
- Monitoring
- Public
- Spring

Oil and Gas Wells
- Gas well
- Oil and gas well
- Oil well
- Enhanced recovery well

20-foot contour interval

Source Water Protection Areas

Source-water protection areas are areas in which activities are likely to affect the quality of the drinking-water source. For more information, see kgsweb.uky.edu/download/water/swapp/swapp.htm.



Planning Guidance by Rock Unit Type

Rock Unit	Foundation and Excavation	Septic Tank Disposal System	Residence with Basement	Highways and Streets	Access Roads	Light Industry and Malls	Intensive Recreation	Extensive Recreation	Reservoir Areas	Reservoir Embankments	Underground Utilities
1. Alluvium	Fair to good foundation material. Easily excavated.	Refer to soil report (Cox, 1980).	Refer to soil report (Cox, 1980).	Refer to soil report (Cox, 1980).	Refer to soil report (Cox, 1980).	Refer to soil report (Cox, 1980).	Refer to soil report (Cox, 1980).	Refer to soil report (Cox, 1980).	Refer to soil report (Cox, 1980).	Refer to soil report (Cox, 1980).	Refer to soil report (Cox, 1980).
2. Loess	Fair to good foundation material. Easily excavated.	Slight to moderate limitations. Variable thickness and permeability.	Severe limitations. Shallow water table may be present.	No limitations.	No limitations.	No limitations.	No limitations.	No limitations.	Slight limitations.	Slight limitations.	No limitations.
3. Sandstone, shale	Fair to good foundation material; moderately difficult excavation.*	Severe limitations. Thin soils and impermeable rock.	Severe to moderate limitations. Rock excavation; locally, upper few feet may be rippable. Steep slopes.*	Severe limitations. Rock excavation; locally, upper few feet may be rippable. Underclay susceptible to slumping. Steep slopes.*	Moderate limitations. Rock excavation. Steep slopes.	Severe limitations. Rock excavation; locally, upper few feet may be rippable. Steep slopes.*	Severe limitations. Steep slopes.	Slight to moderate limitations.	Slight limitations. Reservoir might leak where rocks are fractured.*	Severe limitations.	Moderate limitations. Highly variable amount of earth and rock excavation.
4. Shale, siltstone, sandstone, limestone, coal, underclay	Fair to good foundation material; difficult excavation.*	Severe limitations. Thin soils and impermeable rock.	Severe to moderate limitations. Rock excavation; locally, upper few feet may be rippable. Steep slopes.*	Severe limitations. Rock excavation; locally, upper few feet may be rippable. Steep slopes.*	Moderate limitations. Rock excavation. Steep slopes.	Severe limitations. Rock excavation; locally, upper few feet may be rippable. Steep slopes.*	Severe limitations. Steep slopes.	Slight to moderate limitations.	Slight limitations. Reservoir might leak where rocks are fractured.*	Severe limitations.	Moderate limitations. Highly variable amount of earth and rock excavation.
5. Sandstone	Fair to good foundation material; difficult excavation.	Severe limitations. Thin soils.	Severe to moderate limitations. Rock excavation; locally, upper few feet may be rippable. Steep slopes.	Severe limitations. Rock excavation; locally, upper few feet may be rippable. Steep slopes.	Moderate limitations. Rock excavation. Steep slopes.	Severe limitations. Rock excavation. Steep slopes.	Severe limitations. Steep slopes.	Slight to moderate limitations.	Moderate limitations. Permeable rock.	Severe limitations.	Moderate limitations. Highly variable amount of soil and rock excavation. Steep slopes.
6. Limestone, shale	Fair to good foundation material; difficult excavation.	Severe limitations. Thin soils and impermeable rock.	Severe to moderate limitations. Rock excavation; locally, upper few feet may be rippable. Steep slopes.	Severe limitations. Rock excavation; locally, upper few feet may be rippable. Steep slopes.	Moderate limitations. Rock excavation. Steep slopes.	Severe limitations. Rock excavation; locally, upper few feet may be rippable. Steep slopes.	Slight to severe limitations. Steep slopes.	Slight to moderate limitations.	Slight limitations. Reservoir might leak where rocks are fractured.	Severe limitations.	Moderate limitations. Highly variable amount of soil and rock excavation. Steep slopes.
7. Gravel	Fair to good foundation material; moderately difficult excavation.	Slight to moderate limitations. Variable thickness and permeability.	Severe limitations. Shallow water table may be present.	No limitations.	No limitations.	No limitations.	No limitations.	No limitations.	Severe limitations. Leaky reservoir material.	Severe limitations. Leaky reservoir material.	Slight to moderate limitations. Variable materials.

* Coal beds and underclays should not be used for foundations or reservoir embankments because of the presence of expanding pyrite in coal and underclays and the weakness of underclay when it becomes wet.

PLANNING TABLE DEFINITIONS

FOUNDATION AND EXCAVATION

The terms "earth" and "rock" excavation are used in the engineering sense; earth can be excavated by hand tools, whereas rock requires heavy equipment or blasting to remove.

LIMITATIONS

Slight—A slight limitation is one that commonly requires some corrective measure but can be overcome without a great deal of difficulty or expense.

Moderate—A moderate limitation is one that can normally be overcome but the difficulty and expense are great enough that completing the project is commonly a question of feasibility.

Severe—A severe limitation is one that is difficult to overcome and commonly is not feasible because of the expense involved.

LAND USES

Septic tank disposal system—A septic tank disposal system consists of a septic tank and a filter field. The filter field is a subsurface tile system laid in such a way that effluent from the septic tank is distributed with reasonable uniformity into the natural soil.

Residences—Ratings are made for residences with and without basements because the degree of limitation is dependent upon ease and required depth of excavation. For example, excavation in limestone has greater limitation than excavation in shale for a house with a basement.

Highways and streets—Refers to paved roads in which cuts and fills are made in hilly topography, and considerable work is done preparing subgrades and bases before the surface is applied.

Access roads—These are low-cost roads, driveways, etc., usually surfaced with crushed stone or a thin layer of blacktop. A minimum of cuts and fills are made, little work is done preparing subgrades, and generally only a thin base is used. The degree of limitation is based on year-around use and would be less severe if not used during the winter and early spring. Some types of recreation areas would not be used during these seasons.

Light industry and malls—Ratings are based on developments having structures or equivalent load limit requirements of three stories or less, and large paved areas for parking lots. Structures with greater load limit requirements would normally need footings in solid rock, and the rock would need to be core drilled to determine the presence of caverns, cracks, etc.

Intensive recreation—Athletic fields, stadiums, etc.

Extensive recreation—Camp sites, picnic areas, parks, etc.

Reservoir areas—The floor of the area where the water is impounded. Ratings are based on the permeability of the rock.

Reservoir embankments—The rocks are rated on limitations for embankment material.

Underground utilities—Included in this group are sanitary sewers, storm sewers, water mains, and other pipes that require fairly deep trenches.

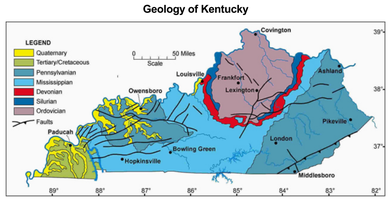
Timber and Wood Products

Along with row crop agriculture, harvesting hardwood trees for furniture and pulp is a sustained land use in McLean County. Photo by Glynn Beck, Kentucky Geological Survey.

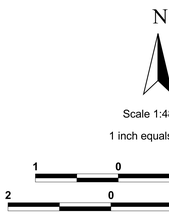
Twin Rivers Inc. is a manufacturer of high-quality hardwood furniture. This facility is located in Livermore, which is historically known for the manufacturing of hardwood furniture. Photo by Glynn Beck, Kentucky Geological Survey.

7.5-Minute Quadrangles

Geology of Kentucky



Learn more about Kentucky geology at www.uky.edu/kgs/geoky/



N

Scale 1:48,000

1 inch equals 3/4 mile

1 0 1 2 Miles

2 0 2 4 Kilometers

Additional Planning Resources

Listed below are Web sites for several agencies and organizations that may be of assistance with landuse planning issues in McLean County:

ces.ca.uky.edu/mclean/—University of Kentucky Cooperative Extension Service
www.gradd.org/—Green River Area Development District
www.thinkkentucky.com/edis/cmnty/cw031/—Kentucky Economic Development Information System
www.uky.edu/KentuckyAtlas/21149.html—Kentucky Atlas and Gazetteer
quickfacts.census.gov/qfd/states/21/21149.html—U.S. Census data
kgsweb.uky.edu/download/kgsplanning.htm—Planning information from the Kentucky Geological Survey

Agriculture

Agriculture is a major part of the McLean County economy. According to the Kentucky Agricultural Statistics Service, 129,175 acres (79 percent) of the 164,045 acres available were planted in corn, soybeans and tobacco in 2002-03. Photoby Glynn Beck, Kentucky Geological Survey.

Approximately 340 chicken houses are in McLean County. Each house holds five to six flocks per year. One flock equals about 27,000 birds. Chicken litter associated with these operations is used as a substitute for synthetic fertilizers on row crop fields. Proper nutrient management is extremely important to ensure that local soil and water resources are not impaired. Photo by Glynn Beck, Kentucky Geological Survey.

The Perdue grain elevator and poultry feed mill located at Livermore. Photo by Glynn Beck, Kentucky Geological Survey.

Topography

The topography of McLean County ranges from flat broad lowlands to very steep-sloped uplands. The elevation ranges from approximately 370 to 610 feet above mean sea level. Photo by Glynn Beck, Kentucky Geological Survey.

Geologic Hazards

The most prominent geologic hazard for McLean County is flooding. Areas underlain by alluvium, unit 1 on the map, are subject to regular flooding. Urban development often exacerbates flooding, and therefore potential flooding should always be considered in urban development plans. Areas of steep-walled drainage, such as that formed in terrain underlain by units 3, 4, 5, and 6, are conducive to flash flooding, especially in developed areas. Flood information is available from the Kentucky Division of Water, Flood Plain Management Branch (www.water.ky.gov/floods/).

None of the faults in McLean County are considered to be active; however, the proximity of active seismic zones, such as the New Madrid, Wabash, or East Tennessee, calls for precautions to be taken for earthquake damage mitigation. The presence of thick alluvium, which normally has a high water table, should also be treated with special concern, because of the possibility of augmented shaking and liquefaction during a strong earthquake. In addition, alluvium often contains high amounts of clay minerals, which can give a soil a high shrink/swell capacity.

Steep slopes are present, especially along streams in areas underlain by units 3, 4, 5, and 6 throughout the county. Steep slopes can develop soil creep and landslides if not properly treated during development. Proper engineering techniques should be followed when developing on hillsides, and care should be taken not to affect property above and below a development site on a hillside.

Several small underground coal mines are in McLean County. The locations of known mine workings, shafts, and adits are shown on the map. Precautions need to be taken when developing over old mined areas, because of the possibility of mine subsidence. Mine subsidence insurance is available in Kentucky.

Surface coal mine areas are prone to settling after reclamation, which may affect structural foundations and roads. Surface mine areas also lack soil structure, which inhibits the growth of vegetation during summer months. Abandoned deep and surface mine boundaries shown on the map are approximate and do not represent all the mining that has occurred in the county.

Water Supplies

The Green River Lock and Dam No. 2 at Calhoun. The Green River is the major drinking-water supply for the residents of McLean County. Groundwater is also used by rural residents for drinking water. Photo by Glynn Beck, Kentucky Geological Survey.

Groundwater

In McLean County, most wells less than 300 feet deep are adequate for a domestic supply. Wells located in the Green River floodplain can produce as much as 100 gallons of hard water per minute. In a thin, highly faulted zone running east-west across the county, between the towns of Beach Grove and Nuckols, yields to drilled wells are unpredictable because of faulting.

Generally, groundwater is hard to very hard, and iron and salt may be present in objectionable amounts. Groundwater often becomes saltier with depth. For more information on groundwater in the county, see Carey and Stickney (2001).

For information on obtaining copies of this map and other Kentucky Geological Survey maps and publications call:

Public Information Center
859.257.3896
877.778.7827 (toll free)

View the KGS World Wide Web site at:
www.uky.edu/kgs

Historical Bridge

This wooden railroad bridge, located in Island, was constructed in 1872 and was relocated to the Island Wooden Bridge Park in 2001. Photo by Glynn Beck, Kentucky Geological Survey.

References Cited

Ashcraft, M.C., and Hosey, K.T., 2003, Spatial database of the Sacramento quadrangle, western Kentucky: Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-1306. Adapted from Hansen, D.E., 1976, Geologic map of the Sacramento quadrangle, western Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ-1306, scale 1:24,000.

Carey, D.I., and Stickney, J.F., 2001, Groundwater resources of McLean County, Kentucky: Kentucky Geological Survey, Open-File Report OF-01-81, 17 p.

Cox, F.R., Jr., 1980, Soil survey of McLean and Muhlenberg Counties, Kentucky: U.S. Department of Agriculture, Soil Conservation Service, 124 p.

Smith, P.C., 2003, Spatial database of the Livermore quadrangle, western Kentucky: Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-1467. Adapted from Hanson, D.E., and Smith, A.E., 1978, Geologic map of the Livermore quadrangle, western Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ-1467, scale 1:24,000.

Solis, M.P., and Hettinger, A., 2000, Spatial database of the Glenville quadrangle, McLean and Daviess Counties, Kentucky: Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-1046. Adapted from Johnson, W.D., Jr., and Smith, A.E., 1972, Geologic map of the Glenville quadrangle, McLean and Daviess Counties, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ-1046, scale 1:24,000.

Solis, M.P., and Terry, J., 2000a, Spatial database of the Beech Grove quadrangle, western Kentucky: Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-1230. Adapted from Fairer, G.M., Norris, R.L., and Johnson, W.D., Jr., 1975, Geologic map of the Beech Grove quadrangle, western Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ-1230, scale 1:24,000.

Solis, M.P., and Terry, J., 2000b, Spatial database of the Delaware quadrangle, western Kentucky: Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-1087. Adapted from Johnson, W.D., Jr., 1973, Geologic map of the Delaware quadrangle, western Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ-1087, scale 1:24,000.

Tyra, M.A., and Crawford, M.M., 2003, Spatial database of the Equality quadrangle, western Kentucky: Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-815. Adapted from Goudarzi, G.H., 1969, Geologic map of the Equality quadrangle, western Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ-815, scale 1:24,000.

Tyra, M.A., and Terry, J., 2000, Spatial database of the Curdsville quadrangle, western Kentucky: Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-1039. Adapted from Fairer, G.M., and Norris, R.L., 1972, Geologic map of the Curdsville quadrangle, western Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ-1039, scale 1:24,000.

Tyra, M.A., and Venard, E., 2000a, Spatial database of the Calhoun quadrangle, western Kentucky: Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-1239. Adapted from Johnson, W.D., Jr., and Smith, A.E., 1975, Geologic map of the Calhoun quadrangle, western Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ-1239, scale 1:24,000.

Tyra, M.A., and Venard, E., 2000b, Spatial database of the Utica quadrangle, western Kentucky: Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-995. Adapted from Johnson, W.D., Jr., and Smith, A.E., 1972, Geologic map of the Utica quadrangle, western Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ-995, scale 1:24,000.

U.S. Fish and Wildlife Service, 2003, National Wetlands Inventory, www.nwi.fws.gov/ [accessed 10/18/04].